

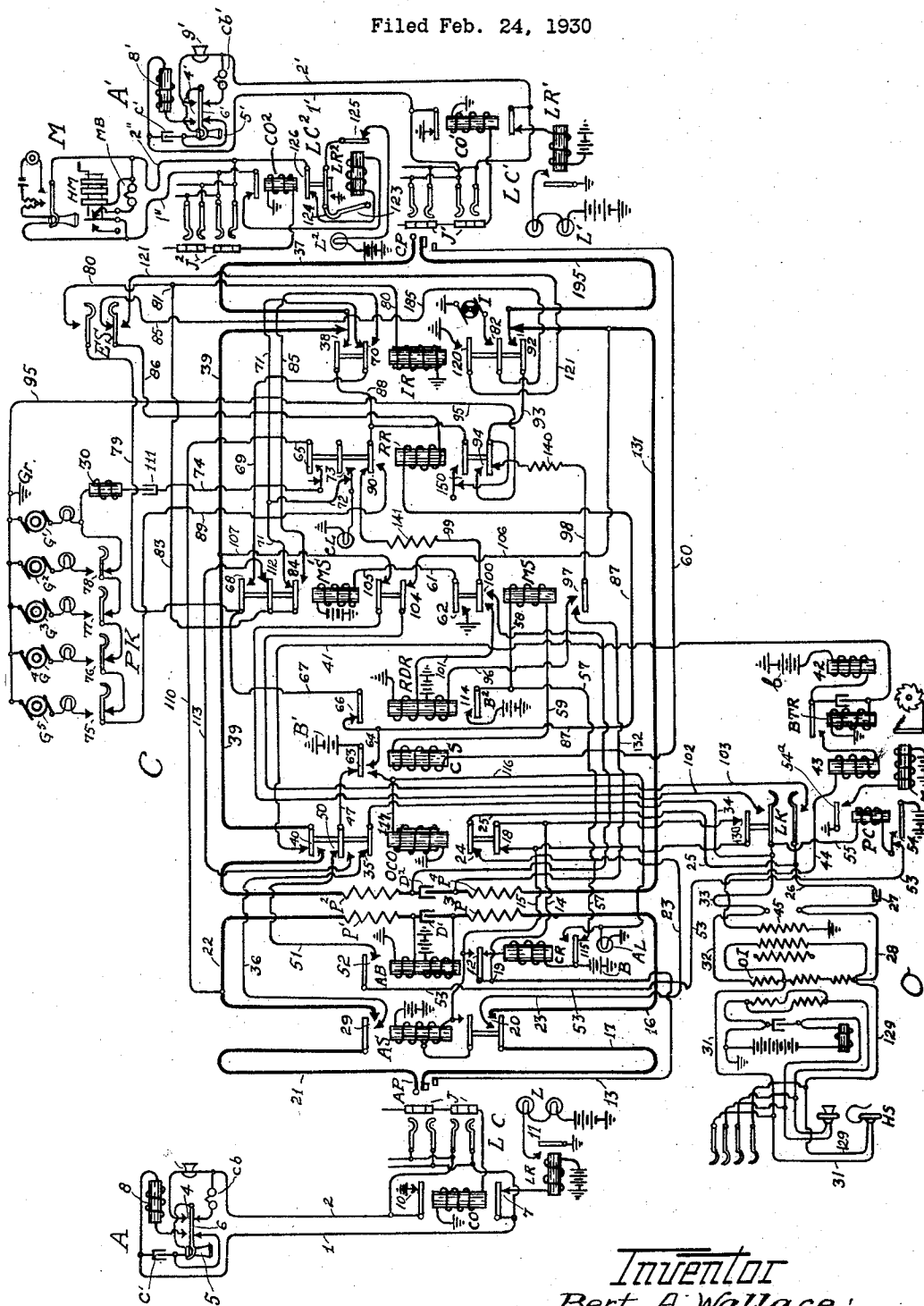
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TELEPHONE SYSTEM

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## UNITED STATES PATENT OFFICE

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## TELEPHONE SYSTEM

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My invention relates to a telephone system effecting communication between subscribers' lines by means of a manual or semi-automatically operated connecting circuit, and is adapted to be used in exchanges which interconnect both magneto and common battery subscribers' lines. The object of the invention is to provide an improved system of the above character adapted to complete connections either between subscribers having common battery type substations or between two subscribers one of whom has a common battery type substation and the other a magneto type substation.

A feature of my invention is a double disconnect cord in which certain of the same relays which are used to effect communication between two common battery substations, are used to complete communication between a common battery and a magneto type substation.

Another feature of my invention is the provision of means for automatically connecting and disconnecting the operator's listening keys to the line, the latter operation being performed at the moment when the connection between the two substations has been completed thus providing for secret service.

Still another feature of my invention relating to the circuit as between a common battery and a magneto type substation is the provision whereby in the course of the disconnect and the recall operations the supervisory and the line lamps pertaining to both lines are put under the control of the common battery subscriber so as to keep the operator properly informed.

The above features, as well as others, will be more clearly pointed out in the ensuing specification and appended claims. For a better understanding of the same reference may be had to the accompanying drawing in which I have illustrated a preferred embodiment of my invention.

In the center of the drawing I have shown a cord circuit C designed to effect communication either from a common battery substation A, shown to the left of the cord C, to another common battery substation A',

shown to the right of the cord C, or from a common battery type substation such as A to a magneto type substation such as M shown also to the right of the cord circuit.

Each of the substations A and A' is connected to a respective line circuit LC or LC' at the central office by a respective pair of lines 1, 2 and 1', 2' connected in multiple to a number of jacks J and J' which appear at a number of operators' positions. Similarly the substation M is connected to its line circuit LC<sup>2</sup> by lines 1'' and 2'' communicating with multiple jacks J<sup>2</sup>. Each of the substations referred to is provided with a line relay LR, LR' or LR<sup>2</sup>, adapted to close the circuit for a number of lamps L, L' and L<sup>2</sup> respectively. This is the usual system employed to enable a plurality of operators to be notified of the incoming call. Cut-off relays CO, CO' and CO<sup>2</sup> are also provided which, when actuated will deenergize the line relays LR, LR' and LR<sup>2</sup> respectively. The cord circuit C is provided with an answering plug AP, a calling plug CP, and a four-party ringing key PK, the latter being associated with the ringing generators G<sup>2</sup>, G<sup>3</sup>, G<sup>4</sup> and G<sup>5</sup> which provide harmonic ringing current, while the generator G' is for the purpose of providing a reverting ringing tone. An interrupter I intermittently connects the ringing current to the called subscriber's line by alternately closing and opening a circuit for the ringing relay RR over a circuit maintained by the interrupter relay IR. A repeating coil composed of four windings P', P<sup>2</sup>, P<sup>3</sup> and P<sup>4</sup> separated respectively by two condensers D' and D<sup>2</sup> is provided for the usual purpose.

At the bottom of the drawing I have shown the operator's circuit O.

A detailed description of the procedure and the automatic operations performed in the case of a call from one common battery substation to another, will now be given.

When the subscriber at the substation A removes his receiver 5 from the switchhook 6, a circuit is established for the line relay LR, traced from battery through relay LR, closed contact 7 of cut-off relay CO, line 1, induction coil 8, closed switchhook contacts 4,

transmitter 9, line 2, normal contact 10 of relay CO to ground. Relay LR upon energizing attracts its armature 11 to complete a circuit for the line lamps L, traced from the battery through the lamps L and closed contact 11 to ground. The lamps L, which are located at different operator's positions are lighted to indicate that a subscriber is calling. One of the operators will now insert an answering plug such as the plug AP of the cord C illustrated into one of the jacks J.

When the plug AP is inserted into the jack J, a circuit is completed for the cut-off relay CO which can be traced from its grounded winding through the sleeve contacts of the jack J and answering plug AP, conductor 13, tap 19, conductor 14, contact 18 of relay OCO, conductor 15, the winding of the answering sleeve relay AS to battery thereby causing said relay AS to energize also. The control relay CR which is in multiple on the same line does not operate at this time because of its high resistance which is put in for the purpose of not permitting the energization of any other operator's set, should the latter try to connect her answering plug to the line after the operator at O has inserted hers. Relay CO thereupon attracts its armatures 7 and 10 breaking the circuit for relay LR whose armature 11 returning to normal extinguishes the lamps L. The energization of relay AS as stated above, and closure of its alternate contacts, besides connecting the terminals of the answering plug AP to the line at contacts 20 and 29, causes also the energization of the answering battery relay AB over a circuit which can be traced from battery through one winding of said relay, through the winding P<sup>3</sup>, talking conductor 16, closed contact 20 of relay AS, talking conductor 17, ring contacts of answering plug AP and jack J, line 1, induction coil 8, upper contact 4 of switchhook 6, line 2, tip contacts of jack J and answering plug AP, heavy conductor 21, closed contact 29 of relay AS, heavy conductor 22, winding P', relay AB, to ground.

By closing their contacts the relays AB and AS effect the energization of the peg cam relay PC associated with the operator's set O over a circuit which can be traced from the battery B' of the calling sleeve relay CS, normal contact 63, conductor 47, normal contact 50 of relay OCO, conductor 51, closed contact 52 of relay AB, conductor 53, spring contact 54, peg cam relay PC, conductors 55 and 34, normal contact 35 of relay OCO, conductor 36, alternate contact 29, conductor 22, coil P', relay AB to ground. The peg cam relay PC now locks up through its contact 54 and completes a circuit for the meter relay M from the battery of the latter to ground at alternate contact 54<sup>a</sup> of PC. By locking the meter relay registers one count in the meter. The energizing of AS also connects the op-

erator's set O to the line by a circuit which can be traced from the lower contact 20 of AS, conductor 23, normal contact 24 of relay OCO, conductor 25, conductor 26 of the operator's set O, condenser 27, conductors 28 and 29, operator head-set HS, conductor 31, induction coil OI, conductors 32, 33, 34, contact 35 of relay OCO, conductor 36 to the line at closed contact 29 of relay AS.

The operator now talks to A and learns of his wish to talk to substation A'. Thereupon she makes a busy test by touching the tip contact of plug CP to the sleeve contact of jack J'. If the latter is already energized by another operator's cord, the first operator will receive the characteristic click in her headphones due to the energization of the busy test relay BTR. This energization is due to the current flowing from another operator's cord circuit, more exactly this current originates in a battery similar to battery B associated with the control relay CR, which, as can be readily seen communicates with the sleeve contact of plug AP. The corresponding circuit can be traced from one jack J' over heavy conductor 37, spring contact 38 of relay IR, conductor 39, normal contact 40 of relay OCO, conductor 41 and busy test relay BTR to ground. The latter relay energizing closes its contact thus completing a circuit from the battery b across the retard coils 42 and 43, conductor 44, and induction coil 45 to ground. The passage of current in the induction coil 45 will cause the usual click in the operator's head-phones in the usual manner.

If the party line A' is idle, the operator inserts the calling plug CP into the jack J' with the result that the calling sleeve relay CS and the marginal relays MS and MS' are energized. The energizing circuit for the relays MS and CS can be traced from battery B of relay CR, normal contact 115, over conductors 57 and 58, relay MS, conductor 59, relay CS, conductor 60, sleeve contacts of plug CP and jack J', relay CO' to ground. The operation of relay MS causes the energization of the auxiliary marginal relay MS', by current flowing from battery, winding of MS', over conductor 61 to ground at closed contact 62 of relay MS.

As a result of relay CS closing its contacts, the operator's cut-off relay OCO is energized, the energizing circuit leading from battery B' of CS, over alternate contact 63, lead 117, relay OCO to ground.

Relay OCO, attracts its armature and by opening contacts 24 and 35 associated with leads 25 and 34 disconnects the operator's set O from the line thus providing for secret service. The opening of contact 35 also interrupts the circuit energizing the peg cam relay PC, as previously traced, restoring the same as well as the meter relay M to normal.

The closing of relay MS' completes a circuit for the calling supervisory lamp CL

traced from the battery B' of relay CS, alternate contact 63, conductor 64, normal contact 66 of ringing disconnect relay RDR, conductor 67, closed contact 68 of relay MS', conductor 69, normal contact 70 of relay IR, conductors 71 and 72, normal contact 73 of relay RR, lamp CL to ground.

The operator next presses the proper plunger of the party ringing key PK to transmit ringing current to the calling bell Cb' at substation A'. Assuming that the generator G<sup>s</sup> is of the proper frequency the operator will actuate the plunger 75 which will remain in its actuated position after the pressure is released from it. The end springs ES are momentarily actuated when the plunger 75 is depressed and complete the following circuit for the ringing interrupter relay IR from the battery B' of relay CS, through alternate contact 63, conductor 64, normal contact 66 of relay RDR, conductors 67 and 79, end spring ES, conductor 80, relay IR, to ground. After the end springs ES return to normal the relay IR locks up over a branch circuit traced from the grounded winding of said relay over conductor 80, tap 81, conductor 83, alternate contact 84 of relay MS', conductor 85, alternate contact 70 of relay IR, conductor 69, closed contact 68 of relay MS', conductor 67, contacts 66 and 63 of relays RDR and CS to battery B'.

The locking of the interrupter relay IR completes a circuit for the ringing relay RR traced from the battery B' of relay CS, alternate contact 63, conductors 64 and 87, ringing relay RR, conductor 86, normal end springs ES, conductor 85, and closed contact 82 to the interrupter I and its ground.

Relay RR is operated intermittently thereby connecting ringing current to the signal bell of substation A', from the selected generator G<sup>s</sup> through a circuit which may be traced on the cord side from the tip contact of the calling plug CP, heavy conductor 37, closed contact 38, of relay IR, conductor 88, alternate contact 90 of relay RR, conductor 89, key 75, generator G<sup>s</sup>, generator common ground G<sub>r</sub>, conductor 95, alternate contact 94 of relay RR, conductor 93, closed contact 92 of relay IR, heavy conductor 195 to the ring contact of plug CP. On the line side the circuit can be completed from the tip contact of the calling plug CP over line 1', condenser C', closed contacts 4' of switchhook 6', call bell Cb', line 2', to the ring contact of the calling plug CP. Each time the ringing relay RR is energized to transmit ringing current to the called line the calling subscriber receives an audible ringing tone, over a circuit which can be traced from the revertive ringing tone generator G', through retard coil 30, condenser 111, conductor 74, alternate contact 65 of relay RR, conductors 110 and 22, alternate contact 29, conductor

21 and plug AP from where it is transmitted to the receiver at A in the usual manner.

If there is no response from A' the subscriber at A abandons the call and replaces the receiver, by doing so he breaks the energizing circuit of relay AB, which deenergizes and opens its contact 12 which has taken the place of contact 18, now open, but formerly in the energizing circuit of relay AS, causes the release also of relay AS. By the same action relay AB causes the energization of the control relay CR, current flowing from battery B, the winding of relay CR, normal contact 12 of relay AB, conductor 13, sleeve contact of plug AP, relay CO to ground. By opening its lower contact 115 relay CR disconnects its battery B from the energizing circuits of relays MS and CS which restore to normal releasing at the same time the relays MS', IR and RR whose circuits they control. The ringing therefore stops and the operator noticing the flash of the lamp AL, which had been lighted by the relay CR closing its alternate contact 115, knows that the subscriber has abandoned and withdraws the plugs which brings the cord circuit to normal as subsequently described. However if the call is not abandoned by A but in answer to the signal the subscriber at A' removes his receiver 5' from the switchhook a circuit is established for the ringing disconnect relay RDR which can be traced from the battery and winding of said relay, over conductor 96, closed contact 97 of relay MS, conductor 98, normal contact 94 of relay RR, conductor 93, closed contact 92 of relay IR, heavy conductor 195, ring contacts of the calling plug CP and jack J', line 2', switchhook 6', induction coil 8', line 1', tip contacts of jack J' and calling plug CP, heavy conductor 37, alternate contact 38, conductor 88, normal contact 90 of relay RR, conductor 99, closed contact 100 of relay MS, conductor 101 and relay RDR to ground. If the subscriber answers during a ringing period no action will take place due to the energization of the ringing relay RR; as soon as the relay RR restores its contacts 90 and 94 to normal the circuit for RDR is established. Upon energization relay RDR opens its contact 66 which as previously indicated forms a link in the energizing circuit of relay IR. The latter relay releases thereby deenergizing relay RR by breaking alternate contact 70 of the energizing circuit of the former and contact 82 of that of the latter. The ringing stops and the spring contacts 38 and 92 of relay IR, having returned to normal, the subscribers are now able to converse over the heavily outlined conductors and through the repeating coils, all intermediate contacts being closed. Another result of the energization of relay RDR is the closing of its contact 114 which connects battery B<sup>2</sup> in parallel

with battery B of relay CR to the holding circuit of relay MS and CS.

Secret service is provided by the fact that the operator's connections to the line leading from the listening key LK over conductors 102 and 103, contacts 104 and 105 of relay MS' and conductors 106 and 107 to the line have been broken by the energization of relay MS'.

Assuming that the conversation has been finished and that the subscriber at A is the first to replace his receiver, the latter action will cause the energizing circuit of relay AB to be broken at the switchhook 6. Relay AB restores to normal causing the release of relays AS and CO whose energizing circuits originally controlled by contact 18 of relay OCO have been transferred to contact 12 of relay AB after the energization of these two relays. With its release relay AS opens its contacts 20 and 29 associated with the tip and ring contacts of the answering plug AP thus disconnecting the subscribers from each other. Relay CO releasing puts relay LR in readiness to flash the lamp L in case of recall.

Another result of the release of relay AB and the closing of normal contact 12 is the energization of the control relay CR over a circuit leading from battery B to the ground of relay CO the corresponding portion of the circuit being the same as traced for the energization of said last relay, which is not energized at this time because of the high resistance of relay CR. The energization of relay CR and the closure of its alternate contact 115 causes the lighting of the answering supervisory lamp AL, indicating that the subscriber at A has replaced his receiver, and, through conductor 116, it connects the battery B of relay CR to the energizing circuit of relay OCO, so that relay OCO will stay energized when relay CS releases and disconnects its battery B' from the energizing circuit of relay OCO. A still further result of relay CR closing its contact 115 is the disconnection of the battery B from the holding circuit of relays MS and CS, leaving said relays under the control of battery B<sup>2</sup> associated with relay RDR.

When the subscriber at substation A' replaces his receiver the circuit for relay RDR which as previously shown is controlled by the contacts of switchhook 6', is broken thus opening contacts 114 and 66. The first of these disconnects the battery B<sup>2</sup> from the energizing circuit of relays CS, MS and CO' which thereupon return to normal causing also the relay MS', which as has been indicated is controlled by relay MS, to return to normal. The release of relays MS' and CS completes a circuit for the calling supervisory lamp CL which can be traced from the lamp and its ground through contact 73 of relay RR, conductors 72 and 71, normal contacts 84 and 112 of relay MS', conductor 113,

closed alternate contact 50 of relay OCO, contact 63 of relay CS to battery B'. At the same time the relay IR is re-energized by a circuit traced from its grounded winding over conductors 80 and 83 to contact 112 of relay MS', from where it communicates with the battery B' of relay CS over a portion of the circuit as just traced for lamp CL. Concomitantly relay CO' having returned to normal, as above stated, puts the relay LR' in readiness to flash the lamp L' in case of a recall by the subscriber at A'.

When the operator notices that both supervisory lamps are glowing, she knows that the conversation is terminated and removes the plugs from the jacks as result of which the circuit as traced for relay CR is broken at jack J, and said relay returns to normal opening its alternate contact 115, thus extinguishing lamp AL and releasing relay OCO. The release of relay OCO in turn causes the release of relay IR by opening alternate contact 50 forming a link in the energizing circuit of said last relay as previously traced. All the elements of cord C have now returned to normal.

If after the completion of a call and before the plugs have been withdrawn from their respective jackets the subscriber at A wishes to make a recall he will remove his receiver from the switchhook which will light the lamps L as a signal to the operator. The latter will depress the listening key LK, said key communicating with the line through conductors 102 and 103, closed contacts 104 and 105 of relay MS' and conductors 106 and 107, which permits the operator to converse with the subscriber. Upon learning his desire she will again actuate the proper ringing key PK and upon the subscriber at A' removing his receiver the operation of the cord circuit will be reenacted as previously described.

If after the completion of the conversation the subscriber at A has replaced his receiver while the subscriber at A' has not, the subscriber at A can still resume the conversation because the line is held in readiness by the battery B<sup>2</sup> associated with relay RDR and the relays CS, MS and MS' controlled by said relay RDR which is not deenergized until the subscriber at A' replaces his receiver.

The cord circuit C may also be used to complete calls between the subscriber at A and another subscriber having a magneto type substation such as M. In this case the initiation of the call by a subscriber from a common battery substation such as A will be similar to the preceding case up to the moment when the operator inserts the calling plug CP into the magneto line jack J<sup>2</sup>. In this case a circuit is completed through the relays MS, CS and magneto line cut-off relay CO<sup>2</sup>. The latter having a high resistance will



reduce the energizing current to a margin whereof the three mentioned relays, only CS and CO<sup>2</sup> will be energized but not MS. The corresponding circuit can be traced from the battery B of relay CR, normal contact 115, conductors 57 and 58, relay MS, conductor 59, relay CS, conductor 60, sleeve contacts of plug CP and jack J<sup>2</sup>, relay CO<sup>2</sup> to ground. As in the previous case the energization of relay CS causes the energization of relay OCO. The operator now actuates the proper key of the party line ringing keys PK as a result of which the end springs ES, by closing, complete an energizing circuit for the relay IR traced from the battery B' of relay CS through alternate contact 63, conductor 64, normal contact 66 of relay RDR, conductors 67 and 79, end springs ES, conductor 80, relay IR to ground. By closing its contact 120 relay IR completes a circuit for the relay RR traced from the battery B' of relay CS, alternate contact 63, conductors 64 and 87, relay RR, conductor 86, end spring ES, conductor 121, contact 120 of relay IR, to ground. By closing its contacts 90 and 94 relay RR permits a ringing current to flow to the call bell of the substation M over a circuit whose cord portion can be traced from the tip of plug CP over heavy conductor 37, alternate contact 38 of relay IR, conductor 88, alternate contact 90 of relay RR, conductor 89, selected generator, generator common ground Gr, conductor 95, alternate contact 94 of relay RR, conductor 93, alternate contact 92 of relay IR, heavy conductor 195 to the ring of plug CP. The circuit can be completed on the line side from the tip contact of CP, line 1'', magneto calling bell MB, line 2'' to the ring contact of plug CP. The magneto calling bell MB rings only during the time that the operator is actuating the key PK thus keeping the end spring ES closed. At the same time she has connected her headset to the line by depressing the listening key LK through a circuit previously traced. However, the operator's set O is disconnected from the called subscriber's line each time ringing current is applied thereto by the operation of interrupter relay IR. When the subscriber at M answers, the operator releases the ringing key PK thus opening the contacts at ES as a result of which the energizing circuits of IR and RR are interrupted, said relays returning to normal and closing spring contacts 38 and 92 of relay IR thus completing the heavily outlined circuit in the drawing through which the subscribers are able to converse.

When, after the conversation has been finished A hangs up his receiver, he thereby breaks the energizing circuit of relay AB causing the release of the same as well as of relay AS and the energization of relay CR as previously described. The relay CR energizing breaks its contact 115 thereby discon-

necting battery B from the energizing circuit of relays CS and CO<sup>2</sup> as previously traced. It also lights the supervisory lamp AL to give a disconnect signal. The relay CO<sup>2</sup> releasing puts relay LR<sup>2</sup> in readiness to flash the lamp L<sup>2</sup> in case of recall by the subscriber at M. The release of CS causes the supervisory lamp CL to light and the relay IR to energize in the same manner as described in the case of common battery to common battery communication. The remainder of the disconnect operation is also similar. The entire disconnection is controlled by the calling common battery station such as A.

In case the call is being initiated by the subscriber at M who desires to converse with the subscriber at A, the former operates the hand generator HM which will cause the energization of line relay LR<sup>2</sup> in the usual manner. The latter attracts its armatures 123 and 125. The attraction of armature 123 allows the spring 124 to drop down and as the relay LR<sup>2</sup> is deenergized when the hand generator HM is no longer operated, the contact 125 returns to normal. Contact 123 is prevented from returning to normal by the construction of the spring 124. A circuit for the lamp L<sup>2</sup> is now completed and the same is lighted by a current flowing from battery, lamp L<sup>2</sup>, normal contact 125 to ground at spring 124. Upon noticing the glowing lamp L<sup>2</sup> an operator will insert an answering plug AP into one of the jacks J<sup>2</sup>. A circuit is now completed for relays AS and CO<sup>2</sup> which may be traced from battery through relay AS, conductor 15, normal contact 18, conductors 14 and 13, sleeve contacts of plug AP and jack J<sup>2</sup> to ground through relay CO<sup>2</sup>. The latter energizing attracts its armature 126 associated with spring 124 which on rising causes contact 123 to return and extinguishes lamp L<sup>2</sup> by interrupting its circuit at spring 124. The operator at O is connected to the calling subscriber due to the operation of relay AS and is able to talk to the subscriber through the circuit previously traced and to learn of his wishes. The remainder of the procedure and operation is the same as described in the case of common battery to common battery communication.

I have shown that at the time the subscribers at A and M have finished their conversation the subscriber at A by hanging his receiver has caused both supervisory lamp AL and CL to light as well as the line lamps L and L' to be in readiness for a recall. Of the remainder of relays, only CR, OCO and IR are at this moment in operation. If now the subscriber at A wishes to recall, he alternately lifts and deposits his receiver thus causing one or more short flashes of the line lamp L as a signal to the operator. The latter now depresses her listening key LK as a result of which a circuit is completed for the relays AS and CO, said circuit being the

same as for the initiation of the call except that instead of the contact 18 of relay OCO, which is now open, contact 130 of the listening key LK is substituted. Relays AS, CO and AB are energized and relay CR deenergized, as previously described. The release of the latter and closing of its normal contact 115 causes the energization of relays CS and CO<sup>2</sup> and the extinction of the supervisory lamps AL and CL, while at the same time relay IR is released thus once more completing the communication circuit between the two subscribers, the intermediate operation of the relays being as previously described.

15 I have shown a resistance 140 incorporated in conductor 98 between contact 97 of relay MS and contact 94 of relay RR the purpose of which is to damp the sudden rise of voltage across repeating coil P<sup>4</sup> as a result of a momentary short circuit which may occur during the shifting of spring contact 92 of relay IR, the respective circuit comprising the coil P<sup>4</sup>, heavy lead 131, alternate make before break contact 92, conductor 93, normal contact 94 of relay RR, resistance 140, alternate contact 97 of relay MS, conductor 132 back to coil P<sup>4</sup>. Resistance 141 incorporated between contacts 100 and 90 of relays MS and RR performs the same service with respect to repeating coil P<sup>3</sup>, the momentary short circuit being liable to occur at spring contact 38 of relay IR.

I have shown also a contact 150 associated with relay RR the purpose of which is to effect the discharge of the energy due to the capacity of line A' during the ringing operation when the line is alternately charged and discharged.

While I have described a preferred embodiment of my invention, it is to be understood that I do not desire to be limited to the exact application as illustrated and described, but intend to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention, what I claim is new and desire to secure by United States Letters Patent is:

1. A telephone system of the character described including a plurality of subscribers' lines, some of said lines having common battery substations and the remainder having magneto type substations, a cord circuit provided with means for interconnecting any two of said lines, all of said means operating in combination to provide communication between two common battery substations, and some of said means operating in combination to provide communication between a common battery and a magneto type substation.

2. A telephone system of the character described including a plurality of subscribers' lines, part being equipped with common battery type substations and others with mag-

neto type substations, a cord circuit for connecting any two of said lines in a conversational circuit, a set of relays operating in combination to complete said conversational circuit between two common battery type substations, some of said relays being arranged to operate to complete a similar conversational circuit between a common battery and a magneto type substation, and means for automatically disconnecting said subscriber's lines from said cord circuit.

3. A telephone system of the character described including a plurality of subscribers' lines, some having common battery type substations and others having magneto type substations, a cord circuit for connecting any two of said subscribers' lines in a conversational circuit, a set of cooperating relays for said cord circuit, some of said relays operating to suitably connect and disconnect the operator's set associated with said cord circuit, and means for causing the disconnection to take place when the signalling circuit between two common battery subscribers' lines has been completed, and means for automatically disconnecting said subscriber's lines from said cord circuit.

4. A telephone system of the character described including a plurality of subscribers' lines, part having common battery and part magneto type substations, a cord circuit comprising a set of cooperating relays for connecting any two of said substations into a conversational circuit, a plurality of manually as well as automatically controlled ringing sources operating through the instrumentality of some of said relays, a relay adapted automatically to disconnect said ringing sources and to maintain a major portion of said conversational circuit intact when a portion of the same, controlled from a connected common battery substation, has been interrupted.

5. In a telephone system of the character described including a calling subscriber's line of the common battery type and a called subscriber's line of the magneto type, a cord circuit provided with automatic interconnecting means for said lines and with two supervisory signalling means one for each line, and means whereby the common battery subscriber at the end of the conversation automatically announces disconnect by energizing both supervisory signals.

6. A telephone system of the character described including a cord circuit, a plurality of subscriber's lines, some having common battery type substations and others magneto type substations, said cord circuit being arranged to connect any two of said lines in a conversational circuit, an operator's set, automatic means for connecting and disconnecting said operator's set to and from said cord circuit, individual automatic supervisory signalling means for the calling and

for the called subscriber, individual automatic recall signalling means for the calling and for the called subscriber, means enabling the subscriber at the common battery substation to automatically control his own supervisory and recall signalling means, and the supervisory means of the connected magneto type substation.

7. A telephone system of the character described including subscribers' lines of the common battery type and subscribers' lines of the magneto type, a cord circuit for interconnecting said lines, and disconnect signals for each line controlled over said common battery line.

8. A telephone system including a plurality of subscribers' lines, part having common battery and part magneto type substations, a cord circuit for interconnecting any two of said substations, and disconnect signals for each of said lines, controlled solely by said common battery lines.

9. A telephone system including a plurality of subscribers' lines, part having common battery and part magneto type substations, a cord circuit for interconnecting any two of said lines, and means controlled solely by the common battery lines for disconnecting said subscribers' lines from said cord circuit.

10. A telephone system including a calling subscriber's line of the common battery type and a called subscriber's line of the magneto type, a cord circuit for interconnecting said lines, and means controlled by said calling subscriber for disconnecting said lines from said cord circuit.

Signed by me, at Chicago, in the county of Cook and State of Illinois, this 20th day of February, 1930.

BERT A. WALLACE.